Electromagnetic Cloaking Through Plasmonic Resonance

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There is much current interest in electromagnetic cloaking of objects, by exploiting structured materials. One approach has been pioneered by J.B. Pendry [1] and U. Leonhardt [2], and exploits metamaterials to create electromagnetic guiding around the region to be shielded. A second approach [3-6] uses electromagnetic resonances in a coated cylinder, designed to have a resonant interaction between Its coating and the surrounding material, in order to quench polarization responses in dipoles within an analytically-determined cloaking region surrounding the cylinder. The electromagnetic effects referred to are akin to surface plasmon resonances, but have a localized nature, and so we refer to them as anomalous resonances.

We have extended the quasistatic treatment of [4] to include interacting and slowly moving systems of polarizable dipoles or quadrupoles with an arbitrary separation between them, and present animations illustrating that anomalous resonant cloaking still works for complicated assemblies of dipoles, or for higher order multipoles, and that the cloaking region does not depend on the details of the entity to be cloaked. Our approach includes a small amount of loss in the coating material, necessary to permit a unique solution of the electromagnetic problem in the quasistatic limit, and we have shown analytically that as the loss tends to zero cloaking is preserved.

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